TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION.*

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THE recent inroads of surgery into the domain of medicine have not only largely increased the number of operations, but have introduced so many extensive proceedings requiring prolonged anæsthesia that the problem of the administration of anæsthetics has been raised from a comparatively trivial to an important position. The surgeon fully realizes that to a large degree his success depends upon his anæsthetist, that many a skilfully performed operation has been rendered useless by clumsily administered ether and that many a convalescence has been unduly prolonged by over-anæsthetizations. Still the progress of this art has not been commensurate with surgery's advance. We still see, too often, patients profoundly shocked and deeply cyanosed in the hands of inexperienced men—perhaps in those of an obliging practitioner, entirely incompetent to take this important duty upon his shoulders. To a certain extent the text-books are responsible for over-etherization. It is usual to find the statement that surgical anæsthesia requires the absence of all reflexes. This is obviously erroneous teaching and leads to gross over-use of the drug.

A glance at the records and statistics of spinal anæsthesia suffices to show that at this stage it has not approached the usefulness of general narcosis. The mortality is variously estimated at from $^1/_{10}$ to ½ per cent. Failure to produce anæsthesia occurs in 4 per cent. of cases according to Bier, 14 per cent. according to Moynihan, 10 per cent. according to

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Doderlein, etc. The after-effects are likewise more severe, 10 per cent. suffering from severe persistent headache; many have paralysis; nausea and vomiting is not infrequent. Rigidity of the muscles of the neck has been observed many times as well as untold more unusual complications.

An attempt to collect statistics as to postoperative complications and mortality from ether anæsthesia, showed a lamentable absence of records, both in the literature and hospital reports. In three of our leading hospitals no statistics whatever could be collected—in a fourth a list of 1800 cases was traced, with 18 cases of pneumonia, thirteen of which were fatal, giving a percentage of 1 per cent. of pneumonia and of .7 per cent. mortality. This is unusually high; which fact can be partly explained by the type of cases brought to this institution. As in many others, anæsthetization in *this* hospital is the duty of the junior resident, who is usually inexperienced. It is therefore a more or less fair example of statistics of etherization and its mortality in the hands of unskilled men, especially as these records do not show deaths from any of the other complications of ether anæsthesia, such as renal failure, acute cardiac dilatation, apoplexy and shock.

The present series of twenty-five hundred cases without serious complications and absolutely without pneumonia or bronchitis forms therefore a marked contrast.

A word as to what should constitute a complete surgical anæsthesia. It is that degree of sensory and motor depression required to enable the surgeon to complete his operation unhampered by movement or rigidity of the patient's muscles, and not one whit more. From this definition it obviously follows that the degree of anæsthesia varies with each operation and each individual, which fact the competent anæsthetist keeps constantly in mind. The signs and symptoms of sufficient narcosis vary likewise.

In a general way it may be said that complete surgical anæsthesia is indicated by a pupil reacting sluggishly to light, a regular noiseless breathing, a good color, muscular relaxation and absence of cutaneous reflexes. The best guide is the pupil, but unfortunately in from 85 to 90 per cent. of cases it is not reliable during the whole time of narcosis. We find irregularity, inequality, absolute fixation of one or both pupils, etc., etc., in the above percentage of cases. This sign failing the respiration furnishes the best gauge. Close observation of the rhythm, the depth and the sound of breathing will almost invariably indicate the return of reflexes. The irritating vapor causes reflex contractions and consequently a more noisy, more hurried or more spasmodic breathing. Often the alteration is ushered in by one deep inspiration.

It is rarely necessary to carry the anæsthesia beyond a point where slight reflex inhibition of respiration is occasioned by administration of fresh ether.

To keep the patient on the borderland between consciousness and unconsciousness requires the absolute concentration of the anæsthetist. The subject's degree of narcosis varies from minute to minute. It is impossible to watch the details of the operation, or do anything but observe the changes in the patient's condition. It is much easier for the etherizer to carry the anæsthesia into the deep third stage with absolutely fixed dilated pupil, shallow respiration, cyanosis and increasing pulse rate. He then may follow the operation for minutes at a time or otherwise amuse himself, but he does so at the expense of the individual temporarily in his care. Ether is an irritant depressing poison, and each drop needlessly administered increases the danger to the patient's life, and decreases his power of resistance, so sorely needed in his period of convalescence.

In my hands the best results have been obtained by the use of nitrous oxide as a preliminary, followed by the gauze drop method. This has the following undisputed advantages: Nitrous oxide is by all means the safest anæsthetic we have, a series of 300,000 cases without a single death having been recently reported. It is not irritating and therefore greatly enhances the patient's comfort. All the choking, gagging and struggling so often seen where ether alone is used is eliminated. It greatly reduces the length of time required to produce surgical anæsthesia, the average being from seven to eight minutes, and likewise greatly reduces the amount of ether required. This is especially true, as it is a well-known fact that it often requires as much, or more ether to anæsthetize a patient as it does to keep him under its influence for a considerable length of time. Its disadvantages are: nitrous oxide requires a more or less bulky apparatus, it is expensive, and in about 50 per cent. of cases, principally males and children, leads to an increased secretion from the respiratory mucous membrane. This last disadvantage would be an objection indeed had we no way to prevent, or at least to limit it. The most efficient preventative is the administration of a hypodermic injection of a full dose of morphine and atropine twenty minutes before the anæsthesia is commenced. This has many uses. The morphine quiets the patient, and to some extent depresses the nervous system so as to limit the amount of ether required. The atropine controls mucus secretion. Preliminary sprays of adrenalin and cocaine solution are also of some use. A thorough spraying of the mucous membrane of the nose and throat furthermore eliminates the rare danger of reflex cardiac inhibition occasionally observed as the result of the first administration of ether. If mucus is secreted in excess, notwithstanding these preliminary precautions, great care is necessary. Under no circumstances should such a patient be deeply anæsthetized—never to the point where inhaled mucus ceases to cause a reflex cough. The common practice of swabbing out the mouth and throat by gauze or other sponges is worse than useless; mucus reappears in less than two minutes and the friction of the sponges increases the flow. Raising the patient's shoulders allowing the head to extend fully while placed on its side allowing the mucus to flow into the cavity of the cheek thence leak out at the angle of the mouth, is the best treatment for this condition. Occasionally repeated sprayings and another dose of atropine helps to control the ceaseless flow.

As to the administration of ether itself the open method, and the most open one, namely, gauze, was invariably used.

Pads about four by five inches and about eight layers in thickness form the most convenient method of administering the drug. The concentration of the vapor may be regulated by the number of layers of gauze employed. Sixteen is about the average number, children requiring less, women less than men, the latter frequently calling for twenty-four layers. If great concentration is required the ether may be dropped upon the under gauze and then covered by an overlaying pad, which will practically exclude the air. More ether is required by the gauze than by any other method, the average amount for men being seven to eight ounces for the first hour, five or six for women. After this time the amount is greatly reduced, especially if a morphine preliminary has been employed, it not being an unusual occurrence to have thirty minutes elapse without the necessity for more vapor. Average amounts of ether required per hour are of no value statistically inasmuch as they vary so greatly with the individual.

If the anæsthetist observes the precautions cited above he will be enabled to carry on his narcosis without endangering the patient's life from over-etherization, which may lead to shock, inhalation pneumonia, kidney complications and great physical depression, reducing vital resistance and healing powers during convalescence.

The management of a so-called difficult case often taxes the ingenuity of the most experienced. Every one knows that notwithstanding the greatest care and knowledge it is sometimes impossible to completely relax some individuals. The type occasioning these difficulties is usually the fat, flabby, plethoric, short-necked male, addicted to the use of alcohol, whose mucous membranes are in a constant state of congestion, and whose arteries are sclerotic. This class of patients run great danger from complete ether narcosis. Their resistance is low, hence pneumonia is more likely to follow inhalation of infected mucus, almost always profuse in these cases. Their arteries are brittle, hence subject to apoplectic rupture, caused by the cyanosis so often the result of the early administration of ether. Their kidneys are, as a rule, impaired and therefore likely to suffer from the anæsthetic, best results in these cases were attained from the following precautions: Twenty minutes before the anæsthesia a very full dose of morphine and atropine is injected hypodermically, the chest is covered by a cotton pneumonia jacket. Immediately before administration of ether, the mouth, nose and throat is thoroughly sprayed with a 2 per cent. eucaine solution. Then a mouth-gag of the Whitehead type is inserted and the preliminary nitrous oxide commenced. When the patient is unconscious, ether is substituted in moderate concentration,—about sixteen layers of gauze moistened with ether being sufficient. At this stage frequently the patient spasmodically and reflexly fixes the jaws defying all attempts to open them, respiration ceases leading to profound cyanosis and the increased blood pressure dependent thereupon, which in turn may cause the rupture of sclerotic vessels. Atropine and morphine will decrease this tendency, but not eliminate it. The presence of the previously inserted mouth-gag saves the situation inasmuch as it is easy to open the jaws, pull the tongue forward, open the larynx and relieve the cyanosis.

If after ten minutes of administration of ether the patient shows no sign of relaxation I change off to chloroform through an Esmarch inhaler, unless contraindicated by the cardiac condition. By observing these precautions it is usually possible to handle these cases in the safest and most satisfactory manner.

A word as to the after-effects of ether anæsthesia: Nausea and vomiting are perhaps the most constant. This annoying, and at times dangerous complication, is greatly reduced by the gas-ether method. In a recent series of one hundred cases anæsthetized by this method by students under my instruction the following results were obtained; persistent vomiting (48 hours) in one case, a gall-bladder operation, the condition being ascribed to a low degree of acute gastric dilatation, 81 per cent. did not vomit at all after regaining consciousness, the remaining 19 per cent. had varying amounts of gastric distress during the first twelve hours, in a few continuing during the first twenty-four hours. The use of oxygen and inhalation of vaporized vinegar have been given up after a thorough trial. If the patient be not over-anæsthetized oxygen is not needed, because there is no cyanosis, and the patient will regain consciousness within ten minutes after the last suture is placed, often moving and talking at random immediately after completion of the operation. The administration of oxygen did not seem to improve upon the statistics given above. A similar conclusion was reached after the use of vinegar.

Ether burns of the face never occur when the gauze drop method is adhered to. If the ether be spread over a sufficiently large evaporating surface and not allowed to drop in one place it will be found that the under surface of the gauze pad is entirely dry. In no case has an ether burn resulted in this series, nor in any of the cases anæsthetized by students.

The advantages of this method are: Its relative safety, comfort to the patient, the time and ether saved in anæsthetization, freedom from complications, such as bronchitis, pneumonia, annoying nausea and vomiting, shock and reduced vital resistance.

In conclusion I would make a plea for less profound anæsthesia in all cases, for rules preventing the junior resident from giving anæsthesia, unaided, and for the more extensive instruction of this art in our medical schools, in the light of its daily increasing importance.